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CURRENT SERIAL RECORDS



# ***WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES***

**Including Columbia River Drainage in Canada**

and  
**FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS**

UNITED STATES DEPARTMENT of AGRICULTURE...SOIL CONSERVATION SERVICE

Collaborating with

CALIFORNIA DEPARTMENT of WATER RESOURCES

and

BRITISH COLUMBIA DEPARTMENT of  
LANDS, FORESTS and WATER RESOURCES

AS OF  
**APR. 1, 1967**

## TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Most of the usable water in western states originates as mountain snowfall. This snowfall accumulates during the winter and spring, several months before the snow melts and appears as streamflow. Since the runoff from precipitation as snow is delayed, estimates of snowmelt runoff can be made well in advance of its occurrence. Streamflow forecasts published in this report are based principally on measurement of the water equivalent of the mountain snowpack.

Forecasts become more accurate as more of the data affecting runoff are measured. All forecasts assume that climatic factors during the remainder of the snow accumulation and melt season as they affect runoff will add to be an effective average. Early season forecasts are therefore subject to a greater change than those made on later dates.

The snow course measurement is obtained by sampling snow depth and water equivalent at surveyed and marked locations in mountain areas. A total of about ten samples are taken at each location. The average of these are reported as snow depth and water equivalent. These measurements are repeated in the same location near the same dates each year.

Snow surveys are made monthly or semi-monthly from January 1 through June 1 in most states. There are about 1400 snow courses in Western United States and in the Columbia Basin in British Columbia. In the near future, it is anticipated that automatic snow water equivalent sensing devices along with radio telemetry will provide a continuous record of snow water equivalent at key locations.

Detailed data on snow course and soil moisture measurements are presented in state and local reports. Other data or reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. The report for Western United States presents a broad picture of water supply outlook conditions, including selected streamflow forecasts, summary of snow accumulation to date, and storage in larger reservoirs.

Snow survey and soil moisture data for the period of record are published by the Soil Conservation Service by states about every five years. Data for the current year is summarized in a West-wide basic data summary and published about October 1 of each year.

Listed below are water supply outlook reports based on Federal-State-Private Cooperative snow surveys. Those published by the Soil Conservation Service may be obtained from Soil Conservation Service, Room 507, Federal Building, 701 N. W. Glisan, Portland, Oregon 97209.

### PUBLISHED BY SOIL CONSERVATION SERVICE

D. A. WILLIAMS, Administrator

The Soil Conservation Service publishes reports following the principal snow survey dates from January 1 through June 1 in cooperation with state water administrators, agricultural experiment stations and others. Copies of the reports for Western United States and all state reports may be obtained from Soil Conservation Service, Western Regional Technical Service Center, Room 507, 701 N. W. Glisan, Portland, Oregon 97209.

Copies of state and local reports may also be obtained from state offices of the Soil Conservation Service in the following states:

STATE	ADDRESS
Alaska	P. O. Box "F", Palmer, Alaska 99645
Arizona	6029 Federal Building, Phoenix, Arizona 85205
Colorado (N. Mex.)	12417 Federal Building, Denver, Colorado 80202
Idaho	P. O. Box 38, Boise, Idaho 83701
Montana	P. O. Box 855, Bozeman, Montana 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washington St., Portland, Oregon 97205
Utah	4001 Federal Building, Salt Lake City, Utah 84111
Washington	840 Bon Marche Bldg., Spokane, Washington 99206
Wyoming	P. O. Box 340, Casper, Wyoming 82602

### PUBLISHED BY OTHER AGENCIES

Water Supply Outlook reports prepared by other agencies include a report for California by the Water Supply Forecast and Snow Surveys Unit, California Department of Water Resources, P. O. Box 388, Sacramento, California 95802 --- and for British Columbia by the Department of Lands, Forests and Water Resources, Water Resources Service, Parliament Building, Victoria, British Columbia





# WATER SUPPLY OUTLOOK as of April 1, 1967

IRRIGATION WATER SUPPLY OUTLOOK GOOD FOR MOST WESTERN AREAS FOR 1967. EXCEPTIONS INCLUDE EXTREME SHORTAGES FOR THE RIO GRANDE, LIMITED SHORTAGES EAST OF THE ROCKIES IN COLORADO AND SOUTHWESTERN COLORADO AND SOUTHERN UTAH. CARRYOVER STORAGE IS NEAR AVERAGE EXCEPT SHORTAGES FOR THE RIO GRANDE AND TWICE AVERAGE IN CENTRAL ARIZONA.

As shown on the map on the opposite page, streamflow prospects are highly varied for 1967. Since the snow accumulation season is near an end, the general pattern of 1967 snowmelt season streamflow is established.

Near record snowmelt season streamflow is expected from the upper Columbia and Kootenai Rivers in Canada. This prospect extends to the upper Missouri and particularly to streams in central Montana between the Yellowstone and Missouri Rivers.

Another region with high, but not record streamflow in prospect is the California Central Valley and the east slope of the Sierras.

In contrast to the above areas, streamflow in New Mexico, Arizona, southern Utah and Colorado will be near minimum of record. With limited storage, another poor water year is in prospect for the Rio Grande and streams on both sides of the Colorado-Great Basin divide in southern Utah. Storage will provide an adequate surface water supply for the central valley of Arizona.

Water supply outlook declined substantially over the Colorado River Basin and adjacent areas during the past month in line with warm and dry weather conditions.

The California Department of Water Resources reports that above normal precipitation over most of the state during March increased to well above normal the snowpack in the Sierra watersheds and generally improved all factors affecting the state's water supply. Therefore, despite the near drouth during February, the water supply outlook for this spring and summer is excellent for all major water use areas in California.

For most of the remaining irrigated areas, water supply prospects are near average.

## SNOWPACK

Snow accumulation in the mountain areas to date ranges from near maximum of record at high elevations in Canada and the northern Rocky Mountains in the United States to almost none in the mountains of Arizona and New Mexico. Other areas of deficient snowpack include all the mountain area of Colorado, southern Utah, all of Nevada except the extreme western section, and most of

Oregon. In these areas the snowpack ranges from 70 to 90 percent of average.

There is a tendency for the heavier snowpacks to be concentrated at the higher elevations in practically all western areas. This distribution of snowpack is somewhat peculiar to the 1966-67 snow season.

## STORAGE

Even with heavy demands and relatively low streamflow in 1966, carryover storage in irrigation reservoirs remains near average. A year ago storage in these reservoirs was near a maximum of record except for the west coast states and Wyoming. Storage in California is above average and over 10 percent above that of a year ago representing an increase of over 1,800,000 acre-feet in storage. Storage for the central valley of Arizona is over twice the average and at this time represents a better than usual surface water supply. Large reservoirs on the Columbia, Colorado and Missouri Rivers have substantial unfilled capacity. The latter reservoir system stores substantially more than for a year ago.

## STREAMFLOW FORECASTS

Selected streamflow forecasts are shown in the tables. Streamflow on the main stem of the Columbia and upper Missouri Rivers and their tributaries is expected to be well in excess of average. The prospects for inflow to Lake Powell dropped substantially during March from near average to 80 percent of average.

Minimum flows are expected for the Rio Grande in New Mexico and the lower Colorado River tributaries in Arizona. Following the pattern of the snowpack, California and east slope Sierra streams will have summer flows well in excess of average.

The flow of the Columbia in Canada is expected to equal the maximum of record for recent years. In the United States section, the flow will be third or fourth highest of record. Multi-purpose reservoirs in the Columbia Basin are at relatively low levels in anticipation of high runoff.

## SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS

APRIL 1, 1967

MAJOR BASIN AND SUB - WATERSHED	WATER EQUIVALENT IN PERCENT OF:		MAJOR BASIN AND SUB - WATERSHED	WATER EQUIVALENT IN PERCENT OF:	
	LAST YEAR	AVERAGE		LAST YEAR	AVERAGE
MISSOURI BASIN			SNAKE BASIN		
Jefferson	180	113	SNAKE above Jackson, Wyo.	130	101
Madison	148	109	SNAKE above Hiese, Idaho	145	109
Gallatin	174	131	SNAKE abv. American Falls Res.	152	113
Missouri Main Stem	185	136	Henry's Fork	172	127
Yellowstone	176	130	Southern Idaho Tributaries	123	90
Shoshone	175	100	Big and Little Wood	147	109
Wind	160	109	Boise	147	106
North Platte	145	90	Owyhee	147	82
South Platte	156	84	Payette	133	100
			Malheur	125	85
			Weiser	112	98
			Burnt	118	92
			Powder	130	85
			Salmon	145	102
			Grande Ronde	135	80
			Clearwater	121	108
ARKANSAS BASIN			LOWER COLUMBIA BASIN		
Arkansas	131	76	Yakima	95	94
Canadian	63	48	Umatilla	78	73
			John Day	114	85
			Deschutes - Crooked	90	87
			Hood	68	74
			Willamette	81	86
			Lewis	73	98
			Cowlitz	96	98
RIO GRANDE BASIN			PACIFIC COASTAL BASIN		
Rio Grande (Colo.)	104	78	Puget Sound	101	98
Rio Grande abv. Otowi Bridge	87	71	Olympic Peninsula	99	110
Pecos	38	49	Umpqua - Rogue	79	92
			Klamath	97	94
			Trinity	80	105
COLORADO BASIN			CALIFORNIA CENTRAL VALLEY		
Green (Wyo.)	156	98	Upper Sacramento	110	130
Yampa - White	135	83	Feather	135	130
Duchesne	123	100	Yuba	125	120
Price	124	82	American	140	120
Upper Colorado	141	90	Mokelumne	155	115
Gunnison	116	76	Stanislaus	180	125
San Juan	85	73	Tuolumne	185	130
Dolores	98	77	Merced	145	110
Virgin	65	60	San Joaquin	175	130
Gila	17	21	Kings	175	140
Salt	5	5	Kaweah	175	115
			Tule	220	90
			Kern	215	140
GREAT BASIN			<i>Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.</i>		
Bear	138	94			
Logan	133	97	<i>Average is for 1948-62 period. California averages are for the period 1931-1960. Based on Selected Snow Courses determined by Dis- tribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.</i>		
Ogden	93	72			
Weber	131	86			
Provo - Utah Lake	125	81			
Jordan	144	86			
Sevier	87	56			
Walker - Carson	165	145			
Tahoe - Truckee	172	128			
Humboldt	125	72			
Lake Co. (Oregon)	114	97			
Harney Basin (Oregon)	174	99			
UPPER COLUMBIA BASIN					
Columbia (Canada)	152	148			
Kootenai	146	137			
Clark Fork	147	108			
Bitterroot	146	104			
Flathead	149	130			
Spokane	118	103			
Okanogan	127	121			
Methow	132	116			
Chelan	134	115			
Wenatchee	90	98			

## MISSOURI BASIN

High elevation snowpack is near the maximum of record on the Gallatin, Yellowstone, Sun, Teton and St. Mary watersheds, and on the Castle, Little Belt, Belt and Snowy mountains in central Montana. Except for isolated areas, snow accumulation is only slightly above average on the headwaters of the Jefferson and Madison rivers.

Except for Jefferson and Madison rivers, streamflow prospects are among the highest of record for the past 30 years. All streamflow forecasts are above average. No water shortages are anticipated, even in areas where demands usually equal or exceed the supply.

Snowpack and streamflow prospects drop sharply in northwestern Wyoming. Forecasts for streams into the Powell basin are for near average this year. Forecasted flows for the Wind River and tributaries above Boysen Dam may result in some shortage where there is inadequate or no storage. Snowmelt season flow will be considerably less than average on streams east of the Big Horn mountains.

The flow of the North Platte into Seminole reservoir is forecast to be near average. Even though storage is down from average, storage and prospective streamflow will provide adequate water for most irrigation systems including those in western Nebraska. Total water for the Kendrick project will be deficient.

There was little, if any, increase in snowpack on South Platte tributaries during March. Medium and low elevation snowpack declined. Stream flow forecasts for these streams in northern Colorado now range from 70 to 80 percent of average. Irrigation storage is down from a year ago, but reserves in irrigation storage, especially in the Colorado-Big Thompson system will meet normal demands this year.

## ARKANSAS BASIN

Streamflow prospects for the Arkansas River dropped to about two-thirds of average due to dry conditions during the past month. Soils are dry. Total storage in the basin is slightly above average, but this is represented mainly by carryover in John Martin Reservoir. In total the season ahead is one of less favorable for water supply for the Arkansas Valley. Less streamflow is expected from the southern tributaries from the Sangre de Cristo Range. Spring rains will have to occur to improve water outlook materially.

Water supply from snowmelt for the Canadian and tributaries in New Mexico will be near minimum of record. Storage is also below average and a year ago.

## RIO GRANDE BASIN

The Rio Grande watershed has the poorest water outlook of any major stream in the West for 1967. There has been very little snowfall in New Mexico mountains and less than average along the Continental Divide in Colorado. Forecasts of flow for the Rio Grande and larger tributaries in Colorado range near 60 percent of average. The forecasts decline to less than 50 percent of average into the Middle Rio Grande District of New Mexico. Storage is well below average and capacity. Groundwater will again be the principal source of water along this stream.

## COLORADO BASIN

The drouth pattern which was established in the Colorado River Basin during February continued during March. Forecasts of flow for upper Colorado River tributaries range from about two-thirds of average for the San Juan and Dolores in southwestern Colorado to near average for the Green River in Wyoming. This represents a drop of about 20 percent with respect to average from March 1 on Colorado and New Mexico tributaries.

Water supply in the upper basin will be adequate to meet local needs along the principal streams but shortages can be expected for the smaller tributaries, particularly in the San Juan Basin in the four corners area.

For Utah tributaries to the Colorado and Green rivers, supplies will be fairly satisfactory along the Duchesne and Price rivers. The southern half of the state, including the irrigated area near Moab in the southeast and along the Virgin River in the southwest, will be short of water this next season.

Inflow to Lake Powell is most likely to be about 6,200,000 acre-feet or 80 percent of average for the April-July 1967 period.

In the lower Colorado River in Arizona, seasonal streamflow including that which has already occurred will be about one-quarter of average and only a small fraction of that which occurred in 1966. Water supplies will be extremely short for irrigated areas depending on direct diversion. Reservoir storage is high and the major projects will have much more than average surface water available.

Storage in reservoirs declined during March due to normal demands and low inflow. Salt River reservoirs remain at twice average with over three times average storage on the Gila and Verde.

Soil moisture is good at higher elevations but poor at medium and lower elevations in all areas.



# SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1967 as of APRIL 1, 1967

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
UPPER MISSOURI			
Jefferson at Sappington, Montana	1966	1967	
Madison near Grayling, Montana <u>1/</u>	331	1080	111
Gallatin near Gateway, Montana	378	495	118
Missouri near Zortman, Montana <u>2/</u>	389	625	140
Sun at Gibson Dam, Montana <u>3/</u>		5400	118
Marias near Shelby, Montana <u>4/</u>	450	730	120
Milk near Eastern Crossing, Montana	435	730	112
Yellowstone at Livingston, Montana	384	215	86
Shields at Clyde Park, Montana	1628	2550	120
Clark Fork at Chance, Montana	68	138	139
Shoshone, Inflow to Buffalo Bill Res., Wyo.	431	670	115
Wind at Dubois, Wyoming	577	765	95
Bull Lake near Lenore, Wyoming	80	88	88
Tensleep near Tensleep, Wyoming	132	196	111
Yellowstone at Miles City, Montana <u>5/</u>	52	59	82
Missouri near Williston, N. Dakota <u>6/</u>		6400	110
		12300	111
PLATTE			
North Platte at Saratoga, Wyoming	309	678	106
Laramie near Jelm, Wyoming <u>7/</u>	62	112	100
Clear at Golden, Colorado		115	86
St. Vrain at Lyons, Colorado		60	75
Cache LaPoudre near Fort Collins, Colorado <u>8/</u>		180	73
ARKANSAS			
Arkansas at Salida, Colorado <u>9/</u>		265	68
Purgatoire at Trinidad, Colorado		18	40
RIO GRANDE			
Rio Grande near Del Norte, Colorado <u>10/</u>		300	61
Conejos near Mogote, Colorado <u>11/</u>		132	67
Rio Chama near LaPuente, New Mexico		105	49
Rio Grande at Otowi Bridge, New Mexico <u>12/</u>		280	46
Pecos at Pecos, New Mexico *		20	38
UPPER COLORADO			
Colorado near Granby, Colorado <u>13/</u>		230	99
Colorado near Glenwood Springs, Colorado <u>14/</u>		1370	89
Roaring Fork at Glenwood Springs, Colorado <u>15/</u>		650	85
Gunnison at Grand Junction, Colorado		900	69
Dolores at Dolores, Colorado		175	67
Colorado near Cisco, Utah		3150	83
Green below Flaming Gorge Res., Utah <u>16/</u> (Apr-July)		1060	94
Yampa at Steamboat Springs, Colorado		250	86
White at Meeker, Colorado		260	78
Duchesne near Tabiona, Utah <u>17/</u>		115	101
Rock Creek near Mountain Home, Utah		99	97
Price near Scofield, Utah <u>18/</u>		32	86
Green at Green River, Utah <u>16/</u>		2850	85
San Juan near Rosa, New Mexico		400	67
Animas at Durango, Colorado		310	68
San Juan near Bluff, Utah <u>19/</u>		670	57
Colorado, Inflow to Lake Powell, Arizona <u>20/</u> (Apr-July)		6200	81
LOWER COLORADO			
Gila near Solomon, Arizona (Apr-May)	79	8	40
Salt at Intake, Arizona (Apr-May)	283	33	23
Verde above Horseshoe Dam, Arizona (Apr-May)	27	19	40



# SELECTED STREAMFLOW FORECASTS

APRIL-SEPTEMBER 1967 as of APRIL 1, 1967

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
GREAT BASIN			
Bear at Harer, Idaho	1966	1967	1967
Logan near Logan, Utah <u>21/</u>	208	270	105
Ogden, Inflow to Pine View Res., Utah <u>22/</u> (Apr-July)		129	97
Weber near Oakley, Utah		79	69
Inflow to Utah Lake, Utah		120	98
Big Cottonwood near Salt Lake City, Utah		260	92
Beaver near Beaver, Utah		35	90
South Fork Humboldt near Elko, Nevada	11	13	53
Humboldt at Palisades, Nevada	54	45	75
Truckee at Farad, California <u>25/</u>	155	100	58
East Carson near Gardnerville, Nevada	127	380	140
West Walker near Coleville, California	98	255	142
		204	146
UPPER COLUMBIA			
Columbia at Revelstoke, British Columbia	21370	24500	122
Kootenai at Wardner, British Columbia	4885	6500	134
Kootenai at Leonia, Idaho	9176	11600	125
Flathead near Columbia Falls, Montana <u>26/</u>	5670	7960	122
Flathead near Polson, Montana <u>26/</u>	6841	9650	124
Clark Fork above Missoula, Montana	1203	2040	111
Bitterroot near Darby, Montana	273	590	101
Clark Fork at Whitehorse Rapids, Montana <u>26/</u>	11474	16500	114
Columbia at Birchbank, British Columbia <u>26/</u>	45000	55000	122
Spokane at Post Falls, Idaho <u>27/</u>		3100	91
Columbia at Grand Coulee, Washington <u>26/</u>	62500	83800	119
Okanogan near Tonasket, Washington		1990	102
Chelan at Chelan, Washington <u>28/</u>		1410	104
Wenatchee at Peshastin, Washington		1880	98
SNAKE			
Snake above Palisades Res., Wyoming <u>29/</u>		2600	100
Snake near Heise, Idaho <u>29/</u>		3800	98
Henry's Fork near Rexburg, Idaho <u>30/</u>		1295	103
Big Lost near Mackay, Idaho <u>31/</u>		200	131
Big Wood, Inflow to Magic Res., Idaho <u>32/</u> (Mar-July)		260	94
Bruneau near Hot Springs, Idaho (March-Sept)		160	75
Owyhee Res., Net Inflow, Oregon		225	59
Boise near Boise, Idaho <u>33/</u>		1400	86
Malheur near Drewsey, Oregon		67	82
Payette near Horseshoe Bend, Idaho <u>34/</u>		1800	91
Snake at Weiser, Idaho		5000	72
Salmon at Whitebird, Idaho		7200	104
Clearwater at Spalding, Idaho		9800	106
LOWER COLUMBIA			
Grande Ronde at LaGrande, Oregon		174	86
Yakima at Cle Elum, Washington <u>35/</u>		935	89
Deschutes at Benham Falls, Oregon <u>36/</u>		485	77
Columbia at The Dalles, Oregon <u>26/</u>	87000	122000	112
Hood near Hood River, Oregon <u>36/</u>		312	82
Willamette at Salem, Oregon <u>36/</u>		4650	84
Lewis at Ariel, Washington <u>37/</u>		1450	100
Cowlitz at Castle Rock, Washington		2950	100

Forecasts in California provided by Department of Water Resources.

Average is for 1948-62 period except California. California is computed for 1911-1960.

Forecasts assume average Effective Climatic Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts Listed on Inside Back Cover.

\* April - June Period

\*\* April - July Period

# SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1967 as of APRIL 1, 1967

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
NORTH PACIFIC COASTAL	1966	1967	
Dungeness near Sequim, Washington	----	180	101
Rogue at Raygold, Oregon	----	799	80
Klamath Lake, Net Inflow, Oregon	----	690	108
CALIFORNIA CENTRAL VALLEY <u>38</u> /**			
Sacramento, Inflow to Shasta, California	1598	2000	112
Feather near Oroville, California	1324	2600	134
Yuba at Smartville, California	770	1400	124
American, Inflow to Folsom Res., Calif.	761	1680	121
Cosumnes at Michigan Bar, California	54	175	134
Mokelumne, Inflow to Pardee Res., Calif.	286	600	125
Stanislaus, Inflow to Melones Res., Calif.	463	880	119
Tuolumne, Inflow to Don Pedro Res., Calif.	767	1425	117
Merced, Inflow to Exchequer Res., Calif.	387	700	113
San Joaquin, Inflow to Millerton Lake, Calif.	837	1620	133
Kings, Inflow to Pine Flat Res., California	825	1650	140
Kaweah, Inflow to Terminus Res., California	149	400	152
Tule, Inflow to Success Res., California	13	80	143
Kern, Inflow to Isabella Res., California	220	700	162

Forecasts in California provided by Department of Water Resources.

Average is for 1948-62 period except California. California is computed for 1911-1960.

Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.

\* April - June Period

\*\* April - July Period

## GREAT BASIN

There is a wide variation in streamflow prospects within this basin. The outlook is for near average for the Bear River and its tributaries in Idaho and northern Utah. This favorable outlook extends generally to the Logan, Ogden and Weber rivers and streams flowing into and out of Utah Lake. The Little Bear River in Cache Valley is the only exception where streamflow forecasts are low.

Snowpack is deficient in the Sevier River area and outlook is poor. In this area reservoir storage is only 75 percent of average. Total storage for all irrigation in reservoirs in Utah is slightly greater than average for this date.

The Humboldt River of northeastern Nevada will have a short water supply with forecasts ranging near 60 percent of average. Storage in Rye Patch is less than one-half that of a year ago.

In contrast, western Nevada streams will have snowmelt season flows up to 150 percent of average. Reservoir storage is down from a year ago but well above average on the Carson, Walker and Truckee rivers. The outlook is comparable to 1962.

Water prospects for the Great Basin area of southeastern Oregon are near average as of this date.

## COLUMBIA BASIN

With maximum or near maximum of record snowpack in British Columbia and northwest Montana the flow of the Columbia River main stem will be among the highest of recent years of record. The volume flow of the Columbia at The Dalles, Oregon is forecast at third or fourth among the past 30 years of record. The most probable forecast for the Columbia at The Dalles is for a flow of 122,000,000 acre-feet for April-September 1967 as compared to 130,000,000 in 1948 and 131,000,000 in 1956. With the heavy snowpack, relatively high peak flows are possible if the snowmelt is delayed. However, there is substantial unfilled capacity in reservoirs on the major streams.

The Water Resources Service of the Province of British Columbia reports that as of April 1 heavy snowpacks extend over the mountains of the Columbia and Kootenai watersheds as well as all other streams in the Province. Maximum snow water equivalents were measured on many snow courses.

In the southern basins the maximum snowpack exists only at the higher elevations. In northern watersheds including the Big Bend area of the Columbia heavy snow accumulation is prevalent at all elevations.

Spring and summer volume runoff is expected to follow the pattern of the snowpack. Forecasts for flow during the April-September period will probably equal or exceed previous maximums. Higher than usual freshet peak stages should be expected on British Columbia snowmelt streams. However, the determining factor as to ultimate river stages will be the weather, particularly the temperature, pattern in April, May and June.

In western Montana snowpack at or near maximum of record was measured at the higher elevations of the Flathead and Kootenai River drainages. Snow at lower elevations was generally near or slightly above average. The seasonal pack trended closer to average on the Upper Clark Fork and Bitterroot drainages. Streamflow for April through September 1967 is forecast at well above average for Kootenai tributaries with the Kootenai at Leona forecast to have the second highest volume flow in the past 30 years. The Flathead tributaries will have the second to third largest volume from snowmelt.

Near average flows are forecast for the Snake River through southern Idaho including the Salmon and Clearwater rivers through the central part of the state. The Big Lost, Little Lost and Little Wood rivers have an unusually heavy snowpack on their watersheds.

The rivers south of the Snake River including those in Owyhee County, Salmon Falls Creek, Goose Creek and Trappers Creek above Oakley Reservoir are forecast to have only a 50 percent of normal water supply. These areas are faced with a critical water shortage.

On the Boise River and on smaller streams in southern Idaho, water is already being diverted for irrigation. Snowmelt has not started and most of the water is coming from storage. In general, the use of stored water above that available from snowmelt streamflow will be required to meet normal demands.

Water supply outlook is good along Columbia River tributaries in Washington with near average flows in prospect. Some shortage is expected in the southeast corner of the state on streams flowing north from the Blue Mountains. Storage for the Yakima irrigated areas is near average and project reservoirs will fill from prospective streamflow. The flow of the Columbia through the state will be much above average, particularly above the junction with the Snake River.

Water users in Oregon may expect reasonably adequate water supplies in 1967. Streamflow forecasts are generally below average in the

northern and eastern parts of the state. In southwestern Oregon on the Umpqua, Rogue, Klamath and Lake County basins near average snowmelt season flows are anticipated.

In areas of the state where shortage of streamflow is expected, average demands can be met by use of storage. Storage in irrigation reservoirs is close to average on a state-wide basis. Soil moisture conditions are reported as good except for the extreme eastern section of the state.

## ALASKA

Snow cover remains near average for the greater portion of interior Alaska. Substantial increases in snow water equivalent were measured on some of the courses on the Susitna and Copper rivers drainage systems during March, but general conditions are near normal for April 1.

The Tanana, Chena and upper Yukon watersheds also have near normal snow cover. Soils in this entire region are very dry and will absorb a good portion of the melting snowpack.

The Koyukuk and middle Yukon region has a relatively heavy snow cover.

Temperatures throughout the winter have been milder than usual and ice thickness on the rivers is considerably less than average. An early breakup is expected for the interior rivers.

An unusually heavy snow cover exists on the Snettisham watershed in southeast Alaska near Juneau.

## CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys in California, reports that the April 1 water supply outlook for the state is excellent. This is especially true in the Central Valley where spring and summer runoff volumes from all major streams are forecasted to be above normal. The drouth weather pattern that persisted over the state throughout February was broken during the second week of March when a firmly entrenched trough developed over the California coast. This condition continued for the remainder of the month and produced four general storms that brought significant precipitation to nearly all parts of the state. Monthly totals were well above normal in most of northern California and in the San Gabriel and San Bernardino mountains of southern California. Below normal amounts were recorded in the southern San Joaquin Valley and most of southern California. Statewide, March precipitation was about 150 percent of average.

The March storms produced substantial increases in the snow water content on all major

## STORAGE IN LARGE RESERVOIRS

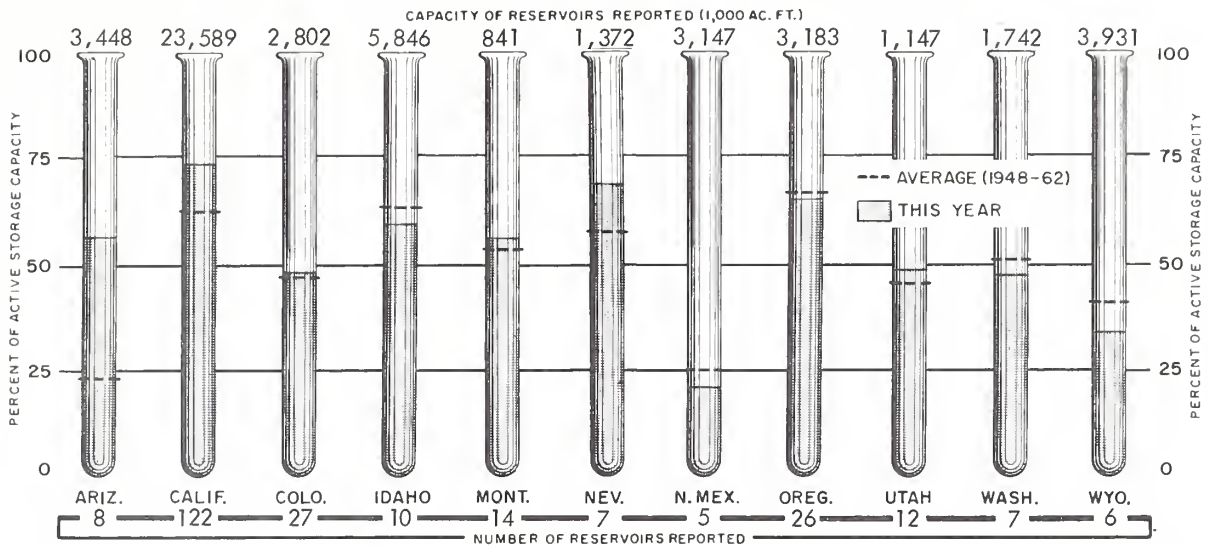
APRIL 1, 1967

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)	BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER MISSOURI			UPPER COLUMBIA		
Boysen	560	321	Chelan	676	91
Buffalo Bill	380	155	Coeur d'Alene	238	291
Canyon Ferry	2043	1028	Flathead	1791	731
Hebgen	377	195	Hungry Horse	2982	1551
Tiber	1316	466	Kootenay	673	137
Yellowtail	1356	698	Pend Oreille	1155	597
Belle Fourche	185	129	Roosevelt	5232	1957
Keyhole	190	131			
Fort Peck	19410	15700	LOWER COLUMBIA		
Fort Randall	5800	3874	Cougar	155	69
Garrison	24500	16209	Detroit	300	147
Oahe	23600	16404	Hills Creek	200	106
Big Bend	1900	1739	Lookout Point	337	143
			Yakima Res. (5)	1066	755
PLATTE					
Glendo	786	351	SNAKE		
Pathfinder	1011	246	American Falls	1700	1584
Seminole	982	90	Arrowrock	287	258
City of Denver (6)	578	380	Anderson Ranch	423	147
Colo-Big Thompson (4)	865	300	Brownlee	980	347
			Cascade	653	134
ARKANSAS			Jackson	847	508
Conchas	280	187	Lucky Peak	278	38
John Martin	367	198	Palisades	1202	597
			Owyhee	715	423
RIO GRANDE					
Elephant Butte	2207	275	PACIFIC COASTAL		
El Vado	194	1	Cachuma	205	206
			Casitas	254	116
UPPER COLORADO			Clair Engle	2500	2135
Flaming Gorge	3789	2092	Clear Lake	440	219
Navajo	1709	357	Nacimiento	350	282
Powell	28040	7368	Ross	1203	866
Blue Mesa		390	Upper Klamath	584	465
LOWER COLORADO					
Havasu	619	550	CALIFORNIA CENTRAL VALLEY		
Mead	27207	15438	Almanor	1036	700
Mohave	1810	1677	Berryessa	1602	1633
San Carlos	1206	276	Camanche	432	272
Salt River Res. (4)	1755	1436	Don Pedro	290	280
Verde River Res. (2)	323	145	Folsom	1010	630
			Hetch-Hetchy	360	99
GREAT BASIN			Isabella	570	280
Bear	1421	1099	McClure	1026	654
Lahontan	286	250	Millerton	521	492
Rye Patch	179	81	Pine Flat	1013	780
Sevier Bridge	236	82	Shasta	4500	4099
Strawberry	265	97			
Tahoe	732	528			
Utah	1149	700			

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.



# RESERVOIR STORAGE as of APRIL 1, 1967



drainages except the upper Sacramento River basin where the March increment was only slightly above normal. The snowpack, which on the first of March barely exceeded normal for that date, increased to 130 percent of normal for April 1. Although the overall snowpack of April 1, 1967 is not quite as impressive as that of April 1, 1962, the water content at many of the high elevation snow courses exceeds that reported in 1962. The excellent high elevation snowpack should prolong the snowmelt runoff this summer.

Runoff during March in California storms averaged 135 percent of normal. In general, the runoff distribution followed the state's precipitation pattern being much above normal in the central two-thirds and near normal in the extreme northern and southern drainages. Runoff on Central Valley streams for the month averaged about 150 percent of normal varying from a high

of 180 percent of normal for the San Joaquin River above Millerton Lake to 130 percent of normal for the upper Sacramento River. Runoff for the six month period since October 1 has been about 150 percent of average.

Forecasts for April-July runoff for California streams have improved substantially over those reported one month ago and all major snowmelt streams are now predicted to be above normal for this period. Streams tributary to the Sacramento and San Joaquin valleys are forecasted to average 125 percent and 130 percent of normal for the April-July period respectively.

Based on April 1 storage reported for 122 reservoirs with a combined capacity of 23,586,000 acre-feet, the aggregate storage in California reservoirs is 120 percent of normal. This represents a net increase of over 1,860,000 acre-feet in storage during the past year.

RECORDS IN STORAGE

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# EXPLANATION of STREAMFLOW FORECASTS

All flows are observed flows except as adjusted for: 1/ Change in storage in Hebgen Lake. 2/ Change in storage in Canyon Ferry and Tiber reservoirs. 3/ Change in storage in Gibson Reservoir and measured diversions. 4/ Change in storage in Two Medicine, Four Horns and Lake Francis reservoirs. 5/ Change in storage in Boysen and Buffalo Bill reservoirs.

6/ Change in storage in Boysen, Buffalo Bill, Canyon Ferry, Tiber, and Fort Peck reservoirs. 7/ Plus diversions to Cache la Poudre. 8/ Minus diversions from North Platte, Laramie, and Colorado rivers plus measured diversions above station. 9/ Change in storage in Twin Lakes and Sugar Loaf reservoirs minus diversions from Colorado River.

10/ Change in storage in Rio Grande, Santa Maria, and Continental reservoirs. 11/ Change in storage in Platoro Reservoir. 12/ Change in storage in El Vado Reservoir. 13/ Change in storage in Granby Reservoir plus diversions to Cache la Poudre and through Adams Tunnel. 14/ Changes as indicated in (13) plus Moffatt Tunnel diversion. 15/ Plus diversions to Arkansas River.

16/ Change in storage in Flaming Gorge and Big Sandy reservoirs. 17/ Plus diversion through Duchesne Tunnel. 18/ Change in storage in Scofield Reservoir. 19/ Change in storage in Navajo Reservoir. 20/ (Lee's Ferry) Change in storage in Flaming Gorge, Navajo, Lake Powell, and Big Sandy reservoirs.

21/ Plus Utah Power and Light Company tailrace and Logan, Hyde Park, and Smithfield canals. 22/ (Inflow record computed by U. S. Bureau of Reclamation.) 23/ Plus diversion by Weber-Provo Canal and change in storage in Wanship Reservoir. 24/ Change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake City Aqueduct. 25/ Change of storage in Lake Tahoe and Boca Reservoir. (Forecast by Truckee Basin Committee)

26/ Change in storage in any of these reservoirs above the station: Kootenai Lake, Hungry Horse, Flathead Lake, Pend Oreille Lake, F. D. Roosevelt Lake, Lake Chelan, Coeur d'Alene Lake, Brownlee and Noxon; and pumpage at Roosevelt Lake. 27/ Changes in storage in Coeur d'Alene Lake and diversions by Spokane Valley Farms Company and Rathdrum Prairie canals. 28/ Change in storage in Lake Chelan. 29/ Changes in storage for Jackson Lake and Palisades Reservoir above stations. 30/ Change in storage in Henry's Lake, Island Park and Grassy Lake reservoirs and diversions between Ashton and Rexburg.

31/ Change in storage in Mackay Reservoir, and diversion in Sharp Ditch. 32/ (Combined flow Big Wood River nr. Bellevue and Camas Creek nr. Blaine.) 33/ Change in storage in Arrowrock, Anderson Ranch, and Lucky Peak. 34/ Change in storage in Cascade and Deadwood reservoirs. 35/ Change in storage in Keechelus, Kachess, and Cle Elum reservoirs plus diversion by Kittitas Canal. 36/ (Corrected to natural flow). 37/ Change in storage in Merwin, Yale, and Swift reservoirs. 38/ (Corrected for upstream impairments).

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